Sensitivity and cost minimization analysis of radiology versus olive palpation for the
diagnosis of hypertrophic pyloric stenosis

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Radiology and olive palpation for hypertrophic pyloric stenosis (HPS) diagnosis.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis; Cost-minimisation analysis.

Study population
Child patients presenting over three years with a history suggestive of HPS.

Setting
Hospital. The practice setting was the Department of Surgery, Radiology and Pediatrics, Washington University School of Medicine, Missouri, USA. The economic analysis appears to have been carried out at the same institution.

Dates to which data relate
Effectiveness and resource data were collected between 1994 and 1996. No prices were stated.

Source of effectiveness data
Estimates for the sensitivity of radiology versus olive palpation for the diagnosis of hypertrophic pyloric stenosis (HPS) were derived from a single study.

Link between effectiveness and cost data
Retrospective costing was undertaken on the effectiveness study sample.

Study sample
Sample selection appears to have taken place around presenting patients between 1994 and 1996. No power calculations were stated. 234 subjects were identified for study inclusion. 150 subjects (64%) were identified as suffering from HPS. 19% of identified HPS sufferers were African-American, 78% were boys. 13% had a family history of HPS. Mean birth weight was 3.38 kg. Mean weight at the time of presentation was 4.0 kg. There were no significant differences presenting to surgery for those who had imaging studies instead of, or in addition to, palpation of an olive versus those who had a clinical examination alone (0.80 versus 0.86 days, p=0.25). The same was true for comparisons of total days in hospital (2.7 versus 3.0, p=0.2). Serum electrolytes were comparable in HPS patients with and without a palpable olive.
Study design
Case series. No follow-up was performed.

Analysis of effectiveness
The basis of the analysis was not stated although the analysis of the clinical study appears to have been on an intention to treat basis. The primary health outcome was the sensitivity, positive predictive value and accuracy of diagnosis.

Effectiveness results
Olives were palpated in 111 of the 150 patients (74% sensitivity), with one false-positive olive. The olive palpation sensitivity between surgeons ranged from 31% to 100%. Physical examination for an olive had a positive predictive value of 99.3%. Of the 84 subjects with a negative diagnosis, 30 (36%) had both sonography and UGI. Of the 150 positively diagnosed subjects 25 (17%) had more than one imaging study. Sonography and UGI were equally accurate. 3% of radiology studies were indeterminate and required further radiological study (usually using a different method) to make a definitive diagnosis.

Clinical conclusions
Imaging is superfluous if an olive is palpable. Suspected HPS sufferers should obtain a consultation before a radiology study is initiated so long as a surgeon's palpation sensitivity for an olive is at least 37%.

Modelling
Decision tree models were employed to measure the diagnosis and costing of HPS using the alternatives examined.

Measure of benefits used in the economic analysis
Except for the primary outcome of diagnostic accuracy, benefits were measured in terms of cost-minimisation (savings in costs) per treatment schedule.

Direct costs
The perspective of a hospital was adopted for costing predictions (based on charges). Discounting was not appropriate to the period of study. No prices were stated. Direct costs included consultant costs, sonography, UGI, pyloromyotomy-surgical charges, as well as pyloromyotomy average anaesthesia charges and average daily inpatient costs. Costs were expressed as mean diagnostic charges (MDC) and mean total charges (MTC) for model A (all patients first examined by a surgeon followed by surgery for palpable olives) and model B (all patients have a radiological investigation first, and then surgical evaluation if the result is positive).

Currency
US dollars ($).

Sensitivity analysis
One-way sensitivity analyses were performed on mean diagnostic and mean treatment costs per patient against palpation sensitivity.

Estimated benefits used in the economic analysis
Except for the primary outcome of diagnostic accuracy, benefits were measured in terms of cost-minimisation per treatment schedule.
Cost results
Total intervention costs were not reported.

Synthesis of costs and benefits
Costs were presented via formulae for each model used which took into account the palpation sensitivity therein. In model A, \( \text{MDC} = 507 - (221 \times \text{palpation sensitivity}) \) and \( \text{MTC} = 2,543 - (240 \times \text{palpation sensitivity}) \). In model B, \( \text{MDC} = 449 \) and \( \text{MTC} = 2,454 \), and costs were independent of ability to feel an olive. When cost was plotted against palpation sensitivity, model A yielded a lower MDC than model B if palpation sensitivity was at least 26%, and a lower MTC if palpation sensitivity was at least 37%. The study reported a sensitivity of 74% which would result in savings of $100 per patient if all infants suspected of having HPS were examined by a surgeon as a first step.

Authors' conclusions
Although highly sensitive, imaging is superfluous if an olive is palpable. Children suspected of having HPS should have a surgical consultation before radiological study as long as the surgeon's palpation sensitivity is at least 37%. Improved palpation skills will result in maximum financial savings.

CRD COMMENTARY - Selection of comparators
The selection of physical and radiologic examinations as comparators was justified and based on recent trends to use radiological studies as either substitutes for, or complements to, physical examination.

Validity of estimate of measure of benefit
The measures of benefit used in the analysis appear to be a combination of primary outcomes and cost reductions. Essentially, a cost-minimization analysis was performed although the sensitivity of palpation was not consistent and was reported to vary between 23% and 75% and cannot be assumed to be equal to the sensitivity and specificity of radiological tests. In this sense the analysis has some limitations although the authors stated that the positive predictive value of both techniques was equal.

Validity of estimate of costs
The authors chose to use charges as costs which do not reflect opportunity costs of alternative interventions. Sources and price year costing information were absent from the paper.

Other issues
authors prefer sonography for infants as it offers a number of benefits for the patient. Comparisons were made with other studies and the results do not appear to have been reported selectively. The issue of generalisability was addressed and the authors are cautious about generalising these results to other settings due to the fact that the principal variable, namely the sensitivity of palpation, ranged in the study from 31% to 100%. The cost benefits were predicated on this figure. It should also be noted that hypothetical models were used and as such a prospective clinical trial with parallel costing would bring greater validity to these results.

Implications of the study
Further prospective cost-effectiveness studies are required to confirm the findings of the present study. Skills in palpation need to be maintained and are being lost due to the adoption of radiological study.

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Noen stated.

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